nignity. These concepts are now under vigorous attack.

Many forms of thyroid cancer have a relatively benign clinical course even if untreated, and there is still enough controversy regarding the pathologic differentiation of benign from malignant tumors to provide traditionalists with ammunition to defend older attitudes. To date no patient who has had thyroid cancer detected as a result of postirradiation screening tests has died of the disease. However, the most conservative approach is to treat many of the classic concepts about thyroid cancer with skepticism, especially in patients who have received radiation in childhood. Palpation, scintiphotographs and thyroid function tests are indicated in all persons with history of such irradiation. Either a palpable nodule *or* nonpalpable "cold" area on scintiphoto is sufficient indication to at least consider surgical operation. If all thyroid studies give normal findings, treatment with replacement doses of thyroxine may provide some protection against future tumor development.

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## Abnormal Brain Scan Findings Resulting from Prior Electroencephalograms

A BRAIN SCAN and an electroencephalogram are used often in combination to evaluate patients with neurologic symptoms. When these two modalities are required, the brain scan should be done first.

Much of the cranial activity seen on a brain scan results from radionuclide accumulation in the extracellular fluid of the scalp and skull. The minimal scalp irritation associated with the application of electroencephalographic electrodes with electrode glue has been reported to result in a local increase in extracellular fluid concentration and a corresponding increase in activity on the brain scan. In the preceding twelve months at the University of California, San Diego, we have also observed abnormal brain scan findings following an electroencephalogram. The sites of abnormal accumulation were located peripherally and repeat scans several days later gave normal findings.

In summary, because an electroencephalogram may result in minor scalp trauma and localized radionuclide accumulation, a brain scan should be carried out first. When an electroencephalogram is done before the brain scan, the nuclear medicine physician concerned should be made aware of the electroencephalogram and the brain scan should be delayed, if possible, at least 48 hours.

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## Gallium-67 Tumor Imaging

SINCE 1969, scanning with gallium-67 as the citrate has gained wide use, although its acceptance as a routine test in nuclear medicine is still limited because of the variability of uptake in bowel, liver, spleen and bone marrow and the nonspecificity of gallium for tumor.

In tumor evaluation gallium has found its greatest success in the detection and staging of lymphomas. The accuracy in detection of involved sites in Hodgkin's disease has been reported as 65 to 79 percent. The information from gallium scans and lymphangiograms is complementary. Efficacy above the diaphragm is better than below. Non-Hodgkin's lymphoma has a somewhat poorer detection rate and uptake seems to depend on the histocytic component.

Other tumors with high affinity to gallium citrate include bronchogenic carcinomas where mediastinal involvement may be detected while findings on x-ray studies are still normal. Melanoma detection has been evaluated in several institutions and found to be good in lesions larger than 2 cm. Gallium uptake in hepatoma may also be high with a reported detection rate of 70 to 90 percent.

Other tumors show greater variability in uptake even within tumor types. Adenocarcinomas are generally not well detected. Head and neck tumor evaluation has been moderately successful.

Twenty-five to 30 percent of these escaped detection (especially midline tumors).

A practical and useful application is the differential diagnosis of primary or metastatic brain tumors from cerebral infarcts since the latter are much less likely to concentrate gallium than tumors.

It is now generally recognized that gallium uptake is not tumor specific. Foci of inflammation will also show gallium accumulation. This uptake may be very rapid and pronounced. Therefore, gallium scanning has been useful in the search for occult infections.

Gallium scanning is no panacea for tumor detection but it is useful selectively to answer specific questions. Despite the pitfalls, valuable clinical information can be obtained in a noninvasive fashion and in special instances a gallium scan may be the *only* test of merit.

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## Noninvasive Radionuclide Imaging of Damaged Myocardial Tissue

DURING THE LAST two years, it has become apparent that imaging of damaged myocardial tissue, including acute myocardial infarcts, can be accomplished following an intravenous injection of an appropriate radionuclide. The technique, first described by Bonte and co-workers, utilizes an intravenous injection of 15 millicuries of radioactive technetium ($^{99m}$Tc) stannous pyrophosphate, a commonly used bone scanning agent. In a series of patient studies, $^{99m}$Tc stannous pyrophosphate was clearly shown to localize in an area of acute myocardial infarction, the location of which correlated well with electrocardiogram (ECG) localization.

The mechanism of incorporation of the $^{99m}$Tc stannous pyrophosphate into infarcted tissue is thought to be related to the presence of calcium phosphate crystals found within the mitochondria of irreversibly damaged myocardial cells.

Results of animal studies showed that an experimental infarct is imageable at approximately 12 to 16 hours after the infarct, with no change in localization of the radionuclide for up to six days following the infarct. Attempts to image after six days showed that the uptake of the radionuclide in the infarct began to fade and finally diasappeared. The radionuclide does not concentrate in old myocardial infarcts, so the technique might be useful in identifying superimposed acute infarction in a patient in whom findings are abnormal on an ECG. The eventual role that this procedure will play in the workup of suspected myocardial infarcts is still uncertain because the incidence of false positive and false negatives has not been established.

In addition to infarct imaging, other approaches to imaging the myocardium by radionuclide techniques are being studied. Thallium-201 is an example of another promising agent which localizes in normal myocardium but not in damaged myocardium. This agent does not distinguish between acute and chronic damage and therefore may play a complementary role to the $^{99m}$Tc pyrophosphate scan. Potassium-43 and cesium-129 and rubidium-81 have been tested as indicators of myocardial perfusion but there are disadvantages to their use, such as high cost and relatively poor resolution images.

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## The Role of Inhalation Lung Scans in the Diagnosis of Pulmonary Embolus

SINCE THE INCEPTION and development of perfusion lung scanning by Taplin, the primary indication for its use has been in suspected pulmonary embolus. The advantages of this procedure are that it is safe, noninvasive and sensitive. As with most diagnostic procedures of high sensitivity, the abnormalities lack specificity. The major pitfall in interpreting perfusion defects is that reflex pulmonary arteriolar vasospasm occurs with the slightest drop in alveolar oxygen pressure. There-